



## SEQUENCE LISTING

<110> Wang, Zhen-Gang  
Voigt, Christopher A.  
Mayo, Stephen L.  
Arnold, Frances H.

<120> GENE RECOMBINATION AND HYBRID PROTEIN DEVELOPMENT

<130> 09373/100H812-US2

<140> US 09/863,765

<141> 2001-05-23

<150> US 60/207,048

<151> 2000-05-23

<150> US 60/235,960

<151> 2000-09-27

<150> US 60/283,567

<151> 2001-04-13

<160> 4

<170> PatentIn version 3.1

<210> 1

<211> 361

<212> PRT

<213> Enteric coronavirus

<400> 1

Thr Pro Val Ser Glu Lys Gln Leu Ala Glu Val Val Ala Asn Thr Ile  
1 5 10 15

Thr Pro Leu Met Lys Ala Gln Ser Val Pro Gly Met Ala Val Ala Val  
20 25 30

Ile Tyr Gln Gly Lys Pro His Tyr Tyr Thr Phe Gly Lys Ala Asp Ile  
35 40 45

Ala Ala Asn Lys Pro Val Thr Pro Gln Thr Leu Phe Glu Leu Gly Ser  
50 55 60

Ile Ser Lys Thr Phe Thr Gly Val Leu Gly Gly Asp Ala Ile Ala Arg  
65 70 75 80

Gly Glu Ile Ser Leu Asp Asp Ala Val Thr Arg Tyr Trp Pro Gln Leu  
85 90 95

Thr Gly Lys Gln Trp Gln Gly Ile Arg Met Leu Asp Leu Ala Thr Tyr  
100 105 110

Thr Ala Gly Gly Leu Pro Leu Gln Val Pro Asp Glu Val Thr Asp Asn  
115 120 125

Ala Ser Leu Leu Arg Phe Tyr Gln Asn Trp Gln Pro Gln Trp Lys Pro  
130 135 140

Gly Thr Thr Arg Leu Tyr Ala Asn Ala Ser Ile Gly Leu Phe Gly Ala  
145 150 155 160

Leu Ala Val Lys Pro Ser Gly Met Pro Tyr Glu Gln Ala Met Thr Thr  
165 170 175

Arg Val Leu Lys Pro Leu Lys Leu Asp His Thr Trp Ile Asn Val Pro  
180 185 190

Lys Ala Glu Glu Ala His Tyr Ala Trp Gly Tyr Arg Asp Gly Lys Ala  
195 200 205

Val Arg Val Ser Pro Gly Met Leu Asp Ala Gln Ala Tyr Gly Val Lys  
210 215 220

Thr Asn Val Gln Asp Met Ala Asn Trp Val Met Ala Asn Met Ala Pro  
225 230 235 240

Glu Asn Val Ala Asp Ala Ser Leu Lys Gln Gly Ile Ala Leu Ala Gln  
245 250 255

Ser Arg Tyr Trp Arg Ile Gly Ser Met Tyr Gln Gly Leu Gly Trp Glu  
260 265 270

Met Leu Asn Trp Pro Val Glu Ala Asn Thr Val Val Glu Gly Ser Asp  
275 280 285

Ser Lys Val Ala Leu Ala Pro Leu Pro Val Ala Glu Val Asn Pro Pro  
290 295 300

Ala Pro Pro Val Lys Ala Ser Trp Val His Lys Thr Gly Ser Thr Gly  
305 310 315 320

Gly Phe Gly Ser Tyr Val Ala Phe Ile Pro Glu Lys Gln Ile Gly Ile  
325 330 335

Val Met Leu Ala Asn Thr Ser Tyr Pro Asn Pro Ala Arg Val Glu Ala  
340 345 350

Ala Tyr His Ile Leu Glu Ala Leu Gln  
355 360

<210> 2  
<211> 361

<212> PRT  
<213> *Citrobacter freundii*

<400> 2

Ala Ala Lys Thr Glu Gln Gln Ile Ala Asp Ile Val Asn Arg Thr Ile  
1 5 10 15

Thr Pro Leu Met Gln Glu Gln Ala Ile Pro Gly Met Ala Val Ala Ile  
20 25 30

Ile Tyr Glu Gly Lys Pro Tyr Tyr Phe Thr Trp Gly Lys Ala Asp Ile  
35 40 45

Ala Asn Asn His Pro Val Thr Gln Gln Thr Leu Phe Glu Leu Gly Ser  
50 55 60

Val Ser Lys Thr Phe Asn Gly Val Leu Gly Gly Asp Arg Ile Ala Arg  
65 70 75 80

Gly Glu Ile Lys Leu Ser Asp Pro Val Thr Lys Tyr Trp Pro Glu Leu  
85 90 95

Thr Gly Lys Gln Trp Arg Gly Ile Ser Leu Leu His Leu Ala Thr Tyr  
100 105 110

Thr Ala Gly Gly Leu Pro Leu Gln Ile Pro Gly Asp Val Thr Asp Lys  
115 120 125

Ala Glu Leu Leu Arg Phe Tyr Gln Asn Trp Gln Pro Gln Trp Thr Pro  
130 135 140

Gly Ala Lys Arg Leu Tyr Ala Asn Ser Ser Ile Gly Leu Phe Gly Ala  
145 150 155 160

Leu Ala Val Lys Ser Ser Gly Met Ser Tyr Glu Glu Ala Met Thr Arg  
165 170 175

Arg Val Leu Gln Pro Leu Lys Leu Ala His Thr Trp Ile Thr Val Pro  
180 185 190

Gln Ser Glu Gln Lys Asn Tyr Ala Trp Gly Tyr Leu Glu Gly Lys Pro  
195 200 205

Val His Val Ser Pro Gly Gln Leu Asp Ala Glu Ala Tyr Gly Val Lys  
210 215 220

Ser Ser Val Ile Asp Met Ala Arg Trp Val Gln Ala Asn Met Asp Ala  
225 230 235 240

Ser His Val Gln Glu Lys Thr Leu Gln Gln Gly Ile Glu Leu Ala Gln  
245 250 255

Ser Arg Tyr Trp Arg Ile Gly Asp Met Tyr Gln Gly Leu Gly Trp Glu  
260 265 270

Met Leu Asn Trp Pro Leu Lys Ala Asp Ser Ile Ile Asn Gly Ser Asp  
275 280 285

Ser Lys Val Ala Leu Ala Ala Leu Pro Ala Val Glu Val Asn Pro Pro  
290 295 300

Ala Pro Ala Val Lys Ala Ser Trp Val His Lys Thr Gly Ser Thr Gly  
305 310 315 320

Gly Phe Gly Ser Tyr Val Ala Phe Val Pro Glu Lys Asn Leu Gly Ile  
325 330 335

Val Met Leu Ala Asn Lys Ser Tyr Pro Asn Pro Ala Arg Val Lys Ala  
340 345 350

Ala Trp Arg Ile Leu Glu Lys Leu Gln  
355 360

<210> 3  
<211> 361  
<212> PRT  
<213> Yersinia enterocolitica

<400> 3

Thr Lys Leu Thr Glu Leu Gln Val Ala Thr Ile Val Asn Asn Thr Leu  
1 5 10 15

Thr Pro Leu Leu Glu Lys Gln Gly Ile Pro Gly Met Ala Val Ala Val  
20 25 30

Phe Tyr Asp Gly Lys Pro Gln Phe Phe Asn Tyr Gly Met Ala Asp Ile  
35 40 45

Lys Ala Gly Arg Pro Val Thr Glu Asn Thr Leu Phe Glu Leu Gly Ser  
50 55 60

Val Ser Lys Thr Phe Thr Gly Val Ala Gly Glu Tyr Ala Met Gln Thr  
65 70 75 80

Gly Ile Met Asn Leu Asn Asp Pro Val Thr Glu Tyr Ala Pro Glu Leu  
85 90 95

Thr Gly Ser Gln Trp Lys Asp Val Lys Met Leu His Leu Ala Thr Tyr  
 100 105 110

Thr Ala Gly Gly Leu Pro Leu Gln Leu Pro Asp Ser Val Thr Asp Gln  
 115 120 125

Lys Ser Leu Trp Gln Tyr Tyr Gln Gln Trp Gln Pro Gln Trp Ala Pro  
 130 135 140

Gly Val Met Arg Asn Tyr Ser Asn Ala Ser Ile Gly Leu Phe Gly Ala  
 145 150 155 160

Leu Ala Val Lys Arg Ser Gln Leu Thr Phe Glu Asn Tyr Met Lys Glu  
 165 170 175

Tyr Val Phe Gln Pro Leu Lys Leu Asp His Thr Phe Ile Thr Ile Pro  
 180 185 190

Glu Ser Met Gln Ser Asn Tyr Ala Trp Gly Tyr Lys Asp Gly Gln Pro  
 195 200 205

Val Arg Val Thr Leu Gly Met Leu Gly Glu Glu Ala Tyr Gly Val Lys  
 210 215 220

Ser Thr Ser Gln Asp Met Val Arg Phe Met Gln Ala Asn Met Asp Pro  
 225 230 235 240

Glu Ser Leu Gly Asn Asp Lys Leu Lys Glu Ala Ile Ile Ala Ser Gln  
 245 250 255

Ser Arg Tyr Phe Gln Ala Gly Asp Met Phe Gln Gly Leu Gly Trp Glu  
 260 265 270

Met Tyr Ser Trp Pro Ile Asn Pro Gln Gly Val Ile Ala Asp Ser Gly  
 275 280 285

Asn Asp Ile Ala Leu Lys Pro Arg Lys Val Glu Ala Leu Val Pro Ala  
 290 295 300

Gln Pro Ala Val Arg Ala Ser Trp Val His Lys Thr Gly Ala Thr Asn  
 305 310 315 320

Gly Phe Gly Ala Tyr Ile Val Phe Ile Pro Glu Glu Lys Val Gly Ile  
 325 330 335

Val Met Leu Ala Asn Lys Asn Tyr Pro Asn Pro Val Arg Val Gln Ala  
 340 345 350

Ala Tyr Asp Ile Leu Gln Ala Leu Arg  
355 360

<210> 4  
<211> 359  
<212> PRT  
<213> Klebsiella pneumoniae

<400> 4

Tyr Ala Arg Gly Glu Ala Pro Leu Thr Ala Ala Val Asp Gly Ile Ile  
1 5 10 15

Gln Pro Met Leu Lys Glu Tyr Arg Ile Pro Gly Met Ala Val Ala Val  
20 25 30

Leu Lys Asp Gly Lys Ala His Tyr Phe Asn Tyr Gly Val Ala Asn Arg  
35 40 45

Glu Ser Gly Gln Arg Val Ser Glu Gln Thr Leu Phe Glu Ile Gly Ser  
50 55 60

Val Ser Lys Thr Leu Thr Ala Thr Leu Gly Ala Tyr Ala Ala Val Lys  
65 70 75 80

Gly Gly Phe Glu Leu Asp Asp Lys Val Ser Gln His Ala Pro Trp Leu  
85 90 95

Lys Gly Ser Ala Phe Asp Gly Val Thr Met Ala Glu Leu Ala Thr Tyr  
100 105 110

Ser Ala Gly Gly Leu Pro Leu Gln Phe Pro Asp Glu Val Asp Ser Asn  
115 120 125

Asp Lys Met Arg Thr Tyr Tyr Arg His Trp Ser Pro Val Tyr Pro Ala  
130 135 140

Gly Thr His Arg Gln Tyr Ser Asn Pro Ser Ile Gly Leu Phe Gly His  
145 150 155 160

Leu Ala Ala Asn Ser Leu Gly Gln Pro Phe Glu Gln Leu Met Ser Gln  
165 170 175

Thr Leu Leu Pro Lys Leu Gly Leu His His Thr Tyr Ile Gln Val Pro  
180 185 190

Glu Ser Ala Ile Ala Asn Tyr Ala Tyr Gly Tyr Lys Glu Asp Lys Pro  
195 200 205

Val Arg Val Thr Pro Gly Val Leu Ala Ala Glu Ala Tyr Gly Ile Lys  
6

210

215

220

Thr Gly Ser Ala Asp Leu Leu Lys Phe Thr Glu Ala Asn Met Gly Tyr  
 225 230 235 240

Gln Gly Asp Ala Ala Leu Lys Thr Arg Ile Ala Leu Thr His Thr Gly  
 245 250 255

Phe Tyr Ser Val Gly Asp Met Thr Gln Gly Leu Gly Trp Glu Ser Tyr  
 260 265 270

Ala Tyr Pro Leu Thr Glu Gln Ala Leu Leu Ala Gly Asn Ser Pro Ala  
 275 280 285

Val Ser Phe Gln Ala Asn Pro Val Thr Arg Phe Ala Val Pro Lys Ala  
 290 295 300

Met Gly Glu Gln Arg Leu Tyr Asn Lys Thr Gly Ser Thr Gly Gly Phe  
 305 310 315 320

Gly Ala Tyr Val Ala Phe Val Pro Ala Arg Gly Ile Ala Ile Val Met  
 325 330 335

Leu Ala Asn Arg Asn Tyr Pro Ile Glu Ala Arg Val Lys Ala Ala His  
 340 345 350

Ala Ile Leu Ser Gln Leu Ala  
 355